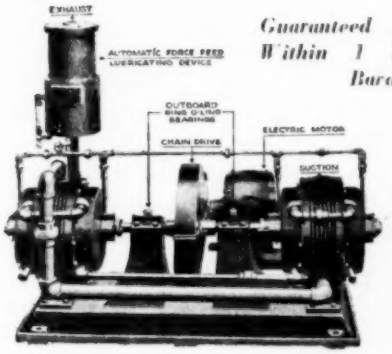
LIBRARY
RECEIVED
1 7 1928

Oil & Fat Industries

The Technical Journal of the Soap and Edible Oil Trades

High Vacuum Pumps



Guaranteed to Exhaust Within 1 Millimeter of Barometer

Regulate the Quality of Your Product

You can regulate the quality of your product by using High Vacuum for de-odorizing edible oils. You can get an exceptionally high quality of product by using Beach-Russ Pumps—**sold with an absolute guarantee of vacuum exhaustion within 1 millimeter of barometer.**

Beach Russ Pumps are made in capacities from 2 cu. ft. to 300 cu. ft. Motor driven units mounted on common bed plate can be furnished with chain or gear drive. All types have heavy bronze bearings and automatic oiling device.

We also manufacture Liquid Power Pumps for light and heavy oils, lard, soap and glycerine; and Vacuum Pumps for laboratory and experimental purposes. Write for catalog 102.

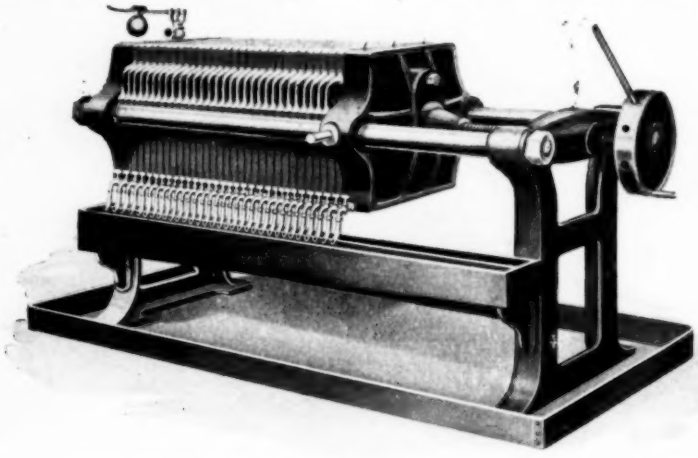
BEACH RUSS CO.

Condensation, Finishing, Heating, Gear, Vacuum and Acid Pumps

46 Church St. New York, N. Y.
Cortlandt 0054-55-56

Branches
BOSTON CHICAGO BUFFALO LOS ANGELES
BALTIMORE MONTREAL, CANADA

Heavy Liquid Pumps, Gas Boosters, Pressure Blowers and Rotary Air Compressors

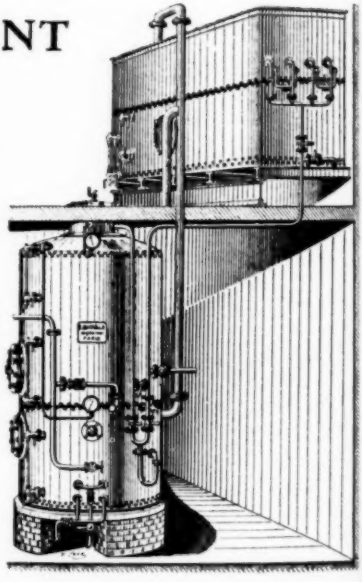


FOR 30 YEARS THE SPERRY FILTER PRESS
HAS BEEN USED FOR FILTERING
CRUDE AND REFINED COTTONSEED OIL

D. R. SPERRY & CO. BATAVIA, ILL.
Send for Prices

BATAILLE SOLVENT EXTRACTOR

Success for your problem assured by the important fact that Bataille Extractors have been in operation for over 30 years; they are used the world over, on every continent; technical labor is not required; each extractor is reduced to the simplest method known and is independent of any other extractor in a battery. Strict guaranties of solvent free oil and meal and successful performance are given.



Edouard Bataille
101 Park Ave. New York City

Manufacturers of Oil Refineries and Extraction Plants Exclusively

OIL & FAT INDUSTRIES. Vol. V. No. 5. May, 1928. A monthly journal published by Russell Palmer at 420 Madison Ave., New York, N. Y. Subscription, $3.00 the year, domestic; $4.00, foreign. Entered at the Post Office, N. Y., Dec. 31, 1925, as second class matter under act of March 3, 1879.

OIL & FAT INDUSTRIES

The Official Organ of

THE AMERICAN OIL CHEMISTS' SOCIETY

President, H. P. TREVITHICK
Chief Chemist, New York Produce Exchange
2 Broadway, New York City

Vice-President, A. W. PUTLAND
Portsmouth Cotton Oil Refining Corp.
Portsmouth, Va.

Secretary-Treasurer, J. C. P. HELM
Helm Laboratories, 705 Tchoupitoulas Street, New Orleans, La.

EDITORIAL ADVISORY BOARD

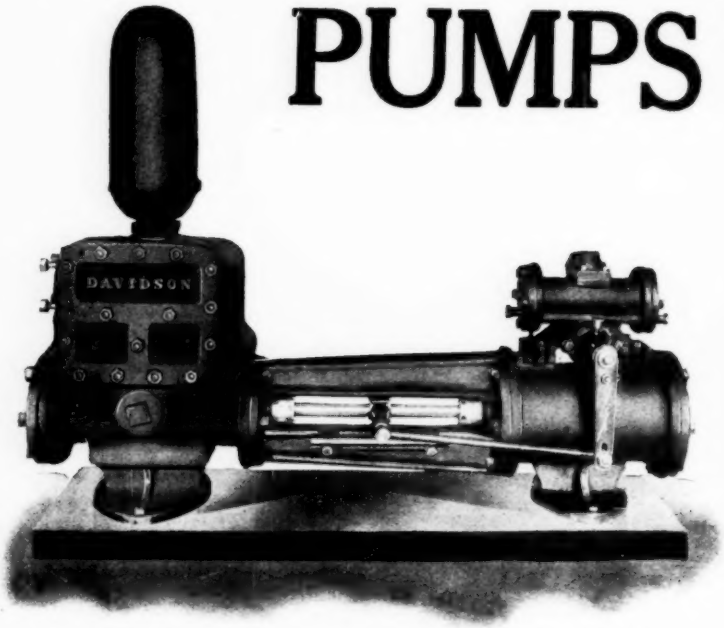
A. D. Holmes *The E. L. Patch Company*
G. S. Jamieson *Bureau of Chemistry*
H. J. Morrison *Proctor & Gamble Company*
Claude E. McLean *Choctaw Cotton Oil Company*
W. D. Richardson *Swift & Company*
Maximilian Toch *Toch Brothers*
H. P. Trevithick *New York Produce Exchange*
David Wesson *The Southern Cotton Oil Company*
A. W. Putland *Portsmouth Cotton Oil Refining Corporation*

VOLUME V | MAY, 1928 | NUMBER 5

CONTENTS

Nineteenth Annual Convention 121
Report of the Moisture Committee,
By W. H. Irwin, Chairman 124
Report of Committee on Revision of Methods of Analysis..... 129
Report of the Color Committee of A. O. C. S. 130
Report of Cake Color Committee 132
Report of Committee on Crude Mill Operations,
By A. K. Schwartz, Chairman 134
Report of the Smalley Foundation Committee,
By H. C. Moore, Chairman 146
A. O. C. S. Notes and Correspondence 152

"DAVIDSON" PUMPS



Davidson "Open Front," Cylinder Pump

Builders of Pumps for

Boiler Feed, Soap, Oils, etc.,
Refrigeration, Condensation Returns,
Vacuum (Wet and Dry)
Filter Presses
Milk (Sanitary)

Send for Illustrated Bulletin 105

M. T. DAVIDSON COMPANY

ESTABLISHED 1877

Main Sales Offices: 154 Nassau Street, New York

Works: 43-53 Keap St., Brooklyn, N. Y.

OIL & FAT INDUSTRIES

VOLUME V MAY, 1928 NUMBER 5

Nineteenth Annual Convention

of

THE AMERICAN OIL CHEMISTS' SOCIETY

NEW ORLEANS, LOUISIANA

May 14-15, 1928

PRESIDENT

H. P. TREVITHICK ..... New York, N. Y.

VICE-PRESIDENTS

A. W. PUTLAND, *First* ..... Portsmouth, Va.
W. D. HUTCHINS, *Second* ..... Savannah, Ga.
J. D. EVANS, *Third* ..... Atlanta, Ga.

SECRETARY-TREASURER

J. C. P. HELM ..... New Orleans, La.

OIL AND FAT INDUSTRIES

Alan Porter Lee, Editor
420 Madison Avenue, New York, N. Y.

GOVERNING COMMITTEE

H. P. TREVITHICK, *Chairman*

A. W. PUTLAND
W. D. HUTCHINS
J. D. EVANS
H. J. MORRISON
J. J. VOLLERTSEN
H. B. BATTLE
R. H. FASH

ANNUAL BANQUET

DAVID WESSON ..... *Master of Ceremonies*

NEW ORLEANS LOCAL COMMITTEE

E. G. WILLIAMS, *Chairman*

J. C. P. HELM
L. J. SAVANA
H. M. SHILSTONE
E. D. ST. PE
W. R. STRYKER
J. M. BURMASTER
F. W. LEIPSNER
C. J. KERBER
J. J. GANUCHEAU

PROGRAM

of the

NINETEENTH ANNUAL CONVENTION

of

The American Oil Chemists Society

Roosevelt Hotel

New Orleans, Louisiana

May 14-15, 1928

Monday, May 14, 1928

(Afternoon Sessions, if necessary, at 2:30 p. m.)

Convention called to order at 9:30 a. m.

Invocation

Greetings from the Interstate C. S. C. Association,
HON. CHRISTIE BENET, *General Counsel*

Reading of Minutes of last meeting

Address of the President.....H. P. TREVITHICK
Report of the Secretary-Treasurer.....J. C. P. HELM
Report of the Governing Committee.....H. P. TREVITHICK
Report of the Membership Committee.....A. W. PUTLAND
Report of the Sampling Committee .....W. G. MCLEOD
Report of the Planning Committee .....H. J. MORRISON
Paper, *Studies on Gossypol*.....DR. E. P. CLARK
Report of the Moisture Committee.....W. H. IRWIN
Paper, *The Use of Organic Peroxides for Bleaching Purposes* .....DR. F. VISSERT HOOFT
Report of Refining Committee.....C. B. CLUFF
Paper, *General Technique of Vegetable Oil Refining*.....DR. ALEXANDER SCHWARCMAN
Report of Neutral Oil Committee.....CLAUDE E. MCLEAN
Report of Color Committee.....J. D. EVANS
Report of Corn Oil Committee.....M. M. DURKEE

Paper, *The Refiner's Problems with Oil Purchased and His Relations with the Commercial Chemist*.....G. G. Fox
Report of the Referee Board.....H. J. Morrison
Report of the Effect of Crude Mill Operations on Crude Oil Produced.....A. K. Schwartz
Our Associate Members—Introductions and Remarks.
Appointment of Special Committees and Miscellaneous Business.

Tuesday, May 15, 1928

Meeting called to order at 9:30 a. m.
Report of the Revision Committee.....C. B. Cluff
Report of Olive Oil Committee.....L. M. Roeg
Paper, *Avocado Oil*.....Dr. G. S. Jamieson
Report of Linseed Committee.....B. H. Thurman
Report of Ammonia Committee.....R. M. Chapman
Paper, *The Decline of the Art of Chemical Analysis*.....Dr. W. D. Richardson
Report of Basic Research Committee.....E. R. Barrow
Report of Cake Color Committee.....S. A. Richardson
Paper, *Report on the Co-operative Investigation of Lovibond Glasses by the Bureau of Standards and the American Oil Chemists' Society*.....I. G. Priest
Report of Fat Analysis Committee.....W. D. Richardson
Report of Detergents Committee.....F. H. Guernsey and L. M. Howell
Report of Dubosq Colorimeter.....David Wesson
Paper, *The Smalley Foundation; What It Is Supposed to Do; What It Has Done*.....Dr. H. B. Battle
Report of the Smalley Foundation.....H. C. Moore
Report of Prize Awards Committee.....David Wesson
Report of the Uniform Methods Committee.....N. C. Hamner
Report of Special Committees
Miscellaneous Business
General Resolutions
Announcements
Election of Officers
Installation Ceremonies
Adjournment

OIL CHEMISTS

Be Sure to have your
Color Vision Tested at the
NEW ORLEANS CONVENTION
May 13, 14, 15 or 16

Report of the Moisture Committee

BY W. H. IRWIN, CHAIRMAN

AT the 1927 May meeting, the Moisture Committee was asked to continue the study made the previous year of the oven method, using a jacketed oven with a glycerin solution in the jacket and electrically heated, and also the Kingman Distillation Method after modifying, as suggested in the previous report of the Committee.

It was decided to send out six samples to the members of the Committee for the moisture determination using the Kingman Distillation Method as modified. The results obtained on the first two samples, after the first modification of the method, were not satisfactory, and the method, as finally modified, is as follows and was applied to the last four samples sent out:

Kingman Distillation Method (Modified) for Cotton Seed Meal, Cake, etc. (For Moisture Only)

Apparatus:

Kingman Distillation Apparatus as shown in sketch. The apparatus should be thoroughly cleaned with cleaning solution before using. Follow by washing in alcohol and drying in an oven.

Reagents:

Acetylene tetrachloride. Benzol.

Determination:

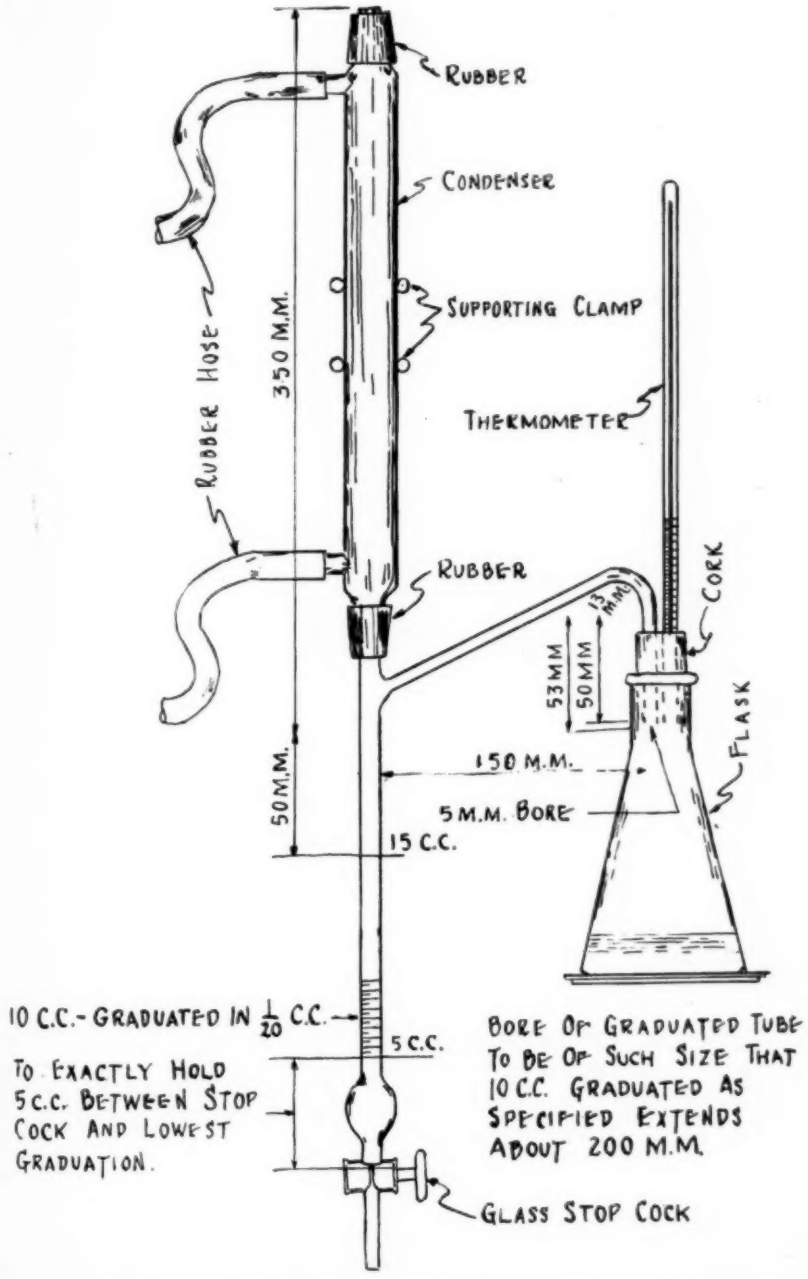
Weigh 40 grams of the sample into a 500 cc. Erlenmeyer flask. Add 125 cc. of acetylene tetrachloride to the sample in the distillation flask, connect with Kingman Distillation tube and condenser and distil as follows:

Heat with a Bunsen flame about 1 inch to 1¼ inch high placed so that the flame strikes the gauze protecting the flask. A thermometer calibrated at each degree should pass through the stopper of the Erlenmeyer flask with its bulb above the liquid. When the temperature rises to about 135°C. take temperature readings at one minute intervals using a watch for accurate timing. Draw off the solvent from time to time when the Kingman tube gets too full. When three successive temperature readings at one minute intervals show the same temperature, shut off the flame and allow the apparatus to cool. The constant boiling temperature is about 142°C. and should be reached in 30 minutes after heating is begun. A little practice and observation will enable the operator to judge the proper amount of heat necessary to finish the distillation in that time.

If the distillation is carried on properly, the water in the collecting tube will remain cool enough so that there is no danger of its redistilling.

After the apparatus has cooled, wash down the condenser and connecting tube into the graduated tube of the apparatus with a little benzol, pushing down any drops of water adhering to the upper part of the condenser tube with a copper wire with a loop on the end. When the water has settled completely, read the column of water, making due allowance for meniscus, and calculate the percentage.

The compilation of results given



Kingman's Moisture Apparatus

below shows the results obtained by the several members of the Committee:

A. O. C. S. CO-OPERATIVE CHECK MEAL RESULTS, 1927-28

	Kingman Distillation Method					
	1	2	3	4	5	6
C. H. Cox, Barrow-Agee Lab's.....	9.37	11.62	9.35	9.12	9.62	9.75
N. C. Hammer, Southwestern Lab's.	9.75	11.00	9.13	8.89	9.75	10.25
W. D. Hutchins, Southern Cotton Oil Co.	10.52	13.12	9.00	9.06	9.29	10.12
C. P. Long, Globe Soap Co.....	9.31	11.37	9.52	9.48	10.14	10.75
M. L. Sheely, Armour Soap Works..	9.62	12.16	9.87	8.68	9.31	10.56
E. H. Tenent, International Sugar Feed Co.	8.47	10.50	9.25	9.08	9.38	9.96
J. J. Vollertsen, Armour & Co.....	9.38	11.48	9.50	9.19	9.42	9.47
W. H. Irwin, Swift & Company.....	9.32	11.75	9.38	9.19	9.75	10.50
Maximum	10.52	13.12	9.87	9.48	10.14	10.75
Minimum	8.47	10.50	9.00	8.68	9.29	9.47
Average	9.49	11.62	9.38	9.09	9.58	10.17

A review of these results indicates that the modification brought the results in better agreement than the results reported the previous year and also better than the results obtained on samples No. 1 and No. 2 of 1927-28 co-operative work. It should be noted that the Kingman moisture results are somewhat higher than the oven method figures, which is probably caused by a slight destructive distillation at the temperature of the solvent, 142°C. The Committee does not feel that it would be practical to use a distillation method except in special cases.

Jacketed Oven:

The same six samples were sent to sixteen Swift & Company laboratories for the moisture determination using the Standard Jacketed Oven (see sketch) and the following method:

Moisture and Volatile for Cotton Seed Cake, Meal, Meats, etc. Using the Standard Jacketed Oven

Apparatus:

1. Balance accurate to one milligram.

2. Official aluminum moisture dish with cover, dimensions 2 inches outside diameter—¾ inch high when completely covered.

3. Standard Oven (or equivalent). See sketch.

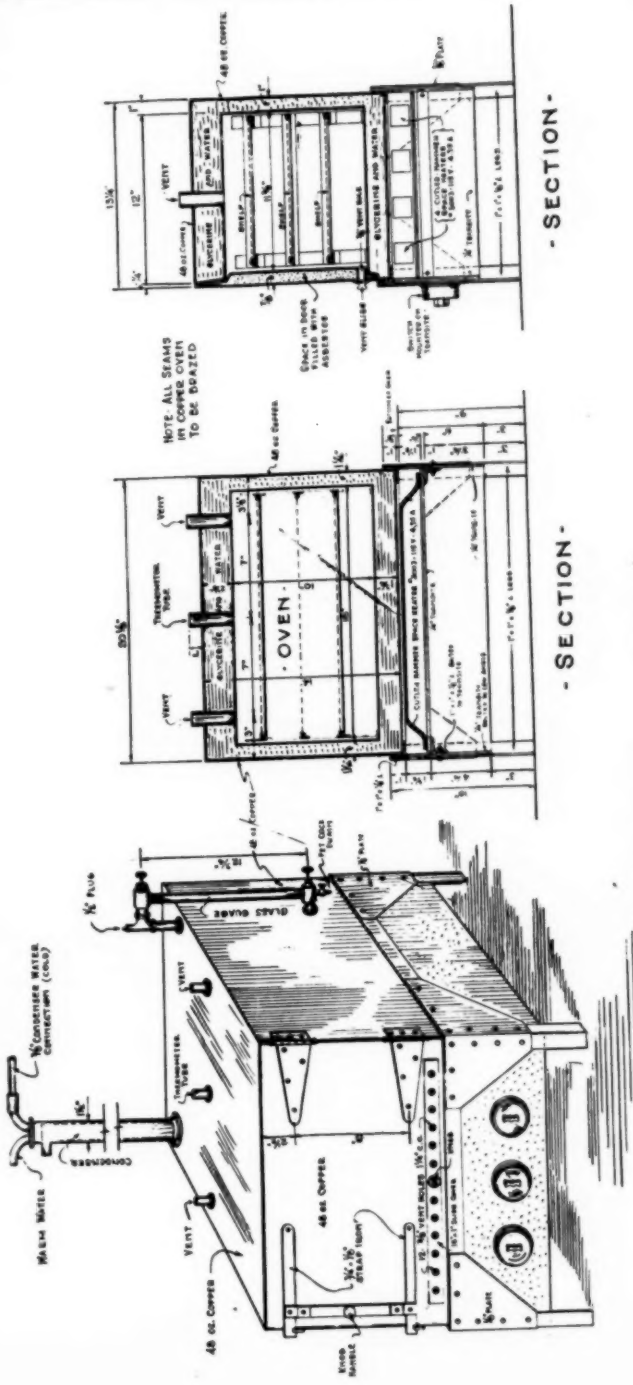
A double walled oven containing a glycerin solution in the jacket; this oven supported on an angle iron base equipped with electric space heating units for heating the glycerin solution.

The jacket of the oven is so constructed that the glycerin solution fills not only the side walls and bottom but also covers the top inner wall to a depth of about one inch. The door is well insulated by means of asbestos or other suitable insulating material and is equipped with a ventilating shutter. All the seams of the oven are brazed.

Determination:

Weigh five grams of the well mixed sample into a tarred aluminum moisture box. Place the sample in the standard oven and heat for five hours at a temperature of 101°C. At the expiration of five hours, remove the box from the oven, cover immediately, and cool in a desiccator. Weigh as soon as cool (within 30 minutes).

Loss in weight divided by 5, times 100 = percentage moisture.


- JACKETED OVEN -
- SECTION -
- SECTION -
OVEN
NOTE: ALL SEAMS IN COPPER OVEN TO BE BRAZED
GLASS DOOR
CONDENSER WATER CONNECTION (COLD)
CONDENSER
THERMOMETER TUBE
VENT
48 OZ. COPPER
WALL
WATER

Note:

The calcium chloride in the desiccators must be changed frequently in order to insure a dry atmosphere. The samples must be weighed back promptly or an increase in weight may occur in the desiccator.

The results given in the compilation below, in the opinion of the Committee, are remarkably good and are very much on the same order as were reported on last year's co-operative work:

which ovens of various types were used, shows a maximum range of 4.35%, a minimum of 1.48%, with an average range of 2.67%.

The maximum range of the co-operative work sent out by the Moisture Committee, in which the jacketed oven was used, was 0.51%, the minimum 0.29%, and the average 0.40%.

The Committee has been in touch with several chemical supply houses with a view of getting ovens, of the type used in the co-

A. O. C. S. Co-Operative Samples of Cottonseed Meal, Numbers 1 to 6, for Moisture Determinations, Swift & Company Laboratories, Using Swift & Company Standard Jacketed Glycerin Oven, Temperature 101°C.

Laboratory	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
1	7.69	10.22	8.90	8.70	9.26	9.70
2	7.70	10.22	9.00	8.72	9.05	9.52
3	7.83	10.33	8.86	8.58	9.05	9.67
4	7.83	10.30	8.98	8.70	9.20	9.60
5	7.96	10.33	8.76	8.48	9.33	9.66
6	7.83	10.35	8.90	8.64	9.18	9.45
7	8.09	10.53	8.91	8.69	9.35	9.66
8	7.73	10.29	8.82	8.55	9.24	9.40
9	7.88	10.33	8.81	8.56	9.05	9.52
10	7.93	10.22	*8.49	8.50	8.91	9.33
11	7.94	10.11	8.74	8.48	9.16	9.59
12	8.01	10.45	8.69	8.44	9.09	9.47
13	8.05	10.43	8.90	8.63	9.24	9.54
14	7.90	10.35	8.93	8.73	9.15	9.71
15	8.07	10.53	8.92	8.69	9.42	9.77
16	7.70	10.20	8.67	8.45	9.00	9.30
Maximum	8.09	10.53	9.00	8.73	9.42	9.77
Minimum	7.69	10.11	8.67	8.44	8.91	9.30
Average	7.88	10.32	8.83	8.58	9.15	9.57

* Not included in maximum, minimum or average.

All of the above samples were dried for a period of five hours. Since there is some objection offered to the length of time required, the same six samples were dried for periods of two, three, four and five hours. The three hour drying time gave results which were very close to the five-hour period, the average difference being only .06%.

An examination of the check meal moisture results on the first twenty-four Smalley Foundation samples for the season 1927-28, in

operative work this year, built at a reasonable figure and has assurances that bids and possibly specimen ovens will be in the hands of the Committee prior to the May Meeting of the Society. It is hoped to have one or more ovens at the May Meeting for inspection.

The Committee feels that the co-operative work warrants the following recommendations:

1. That a jacketed oven of the type shown in the sketch be adopted as standard.

2. That the moisture method us-

ing the standard jacketed oven be adopted and the drying time be fixed at three hours.

3. That the Kingman Distillation Method be suggested for use in special cases where, for any reason, a distillation moisture method appears advisable.

Moisture Committee, A. O. C. S.:

W. H. Irwin, Chairman.
C. H. Cox,
N. C. Hamner,
W. D. Hutchins,
C. P. Long,
M. L. Sheely,
E. H. Tenent,
J. J. Vollertsen.

Report of Committee on Revision of Methods of Analysis

THIS Committee was appointed to eliminate from our Methods all reference to Trading Rules, leaving merely a description of procedure, and to simplify the wording where possible. Its duties were merely editorial and no changes in procedure are made by this Committee. The object of this work was to put the Methods into such shape that they could be adopted and recommended by the American Chemical Society for universal use by all chemists concerned with analyses of any kind where these Methods will apply, even though such chemists are not concerned with cottonseed products or Interstate Rules.

Our present Methods for 1927-28 have been thus revised and sample copies printed. Suggestions for improvement will be welcomed. A few changes in procedure will undoubtedly be made at our 1928 meeting, after which it is proposed to have the complete, up-to-date Methods reprinted in pamphlet form, as the official Methods of this Society, omitting the Interstate Rule numbering. They will then be obtainable from our Secretary at a very small charge.

While Rules 260, 261, 262, 263 and 264 in Chapter XII have been printed with the sample copies as a matter of convenience, it is not intended to include these in the final edition, as they relate only to settlements of trades, specifying which refining test to report, etc., and they can be found in the Interstate Rule Book by those who need them.

The Interstate will doubtless continue to include our Methods in its annual Rule Book for convenience.

It has been suggesfed that we should also have the "Standard Methods for the Sampling and Analysis of Commercial Fats and Oils" of the American Chemical Society, printed in the same pamphlet as our present rules, for these are also official Methods of this Society, as well as of the American Chemical Society. These will be included if the Society so directs.

E. R. BARROW
W. H. IRWIN
C. B. CLUFF, *Chairman.*

Report of the Color Committee of A. O. C. S.

DURING the past season two samples of refined cotton seed oil were sent out to the members of the committee for color reading with the following results:

SAMPLE "A."

	Color	No. Glasses	Temp.	Lamp.
Agee	6.3 R.35 Y.	4	31.C.	150 Watt.
Brownfield	6.0 R.35 Y.	3	21.C.	150 Watt.
Grant	6.0 R.35 Y.	3	28.C.	75 Watt.
Pelofsky	5.0 R.35 Y.	2	23.C.	150 Watt.
Evans	6.2 R.35 Y.	3	30.C.	150 Watt.
Burt	5.5 R.35 Y.	3	34.C.	150 Watt.

SAMPLE "B."

Color

	¾ in. tube	4 oz. bottle	Temp.
Agee	5.	...	25.5C.
Brownfield	4.5	5.5 (Daylight)	21.0C.
Burt	4.8	5.3 (Daylight)	22.0C.
Pelofsky	...	4.3	33.0C.
Grant	Sample lost		
Evans	4.9	...	23.0C.

All of the committee use the ¾-in. glass tube, except one, who used the four ounce sample oil bottle. His readings were consistently lower than the rest.

One member uses the Baily modification of the Wesson tintometer. The others either use the Greiner or a modification of same. The apertures in the eyepieces were all approximately ¼-in. diameter.

Mr. Trevithick was anxious for us to compare the results using 4-oz. sample bottles and the ¾-in. tube. Only one member's tintometer was equipped to use the bottle, and two others read the oil by natural light. They showed the oil much darker than by artificial light.

Mr. Cluff asked the Committee to investigate the apparent changes in the color of refined oils.

On the first sample sent out I asked the members of the Committee to return to me the samples of oils, being careful to expose them as little as possible to the action of light. The samples were sent out on Sept. first and I read them all on Oct. seventh, and they had all lost nearly a whole point in color.

Several of the Committee took a series of oils and kept them away from the light, reading them every three days.

MR. GRANT

	A	B	C	D	E
Feb. 14	5.2R	5.6R	4.8R	6.2R	7.1R
Feb. 17	5.3	5.6	4.8	6.2	7.1
Feb. 20	5.6	5.6	4.8	6.2	7.1
Feb. 24	5.3	5.5	4.7	6.0	6.5
Feb. 28	5.3	5.4	4.8	6.0	6.5
Mar. 1	5.3	5.4	4.8	6.1	6.6
Mar. 7	5.2	5.2	4.6	6.0	6.4

As you will note, the changes on all except one are negligible, but on one the difference is marked.

MR. PELOFSKY

	A	B
Feb. 22	6.2	6.1
Feb. 25	6.2	6.1
Feb. 28	6.2	6.1
Mar 2	6.2	6.1
Mar. 5	6.1	6.1

Mr. Pelofsky also took two samples and exposed them to light with the following results.

	A	B
Feb. 22	6.2	6.1
Feb. 25	6.2	6.1
Feb. 28	6.3	6.2
Mar. 2	6.2	6.1
Mar. 5	6.2	6.1

Mr. Pelofsky found no changes in the oils that he read.

Mr. Agee read two sets, one kept in the dark and one in the light. Reading them at intervals of three or four days.

Kept in Dark

E	F	G	H
5.8	4.6	4.5	6.2
6.0	4.5	4.5	6.1
6.2	4.5	4.7	6.3
6.2	4.4	4.8	6.3

Kept in Daylight

A	B	C	D
6.0	5.8	4.3	6.1
6.0	6.1	4.3	6.3
6.2	6.1	4.5	6.3
6.1	6.0	4.5	6.2

As you will note, the oils that Mr. Agee read showed a tendency to darken up a trifle. His readings were checked by two observers.

On Aug. 18, 1927, I took a sample of refined cotton seed oil that showed a reading of eight red and divided it, putting one bottle away from the light and exposing the other, on which I made readings as follows:

8/18	8R.35Y
9/17	6R.
10/18	5R
12/2	4.8R
2/14	4.8R
4/4	4.7

This oil bleached very rapidly at first and finally became stationary in color.

On the part kept away from the dark the color had gone down to seven, thus losing an entire point of red. I do not think there is any doubt but that some oils will change in color on standing, and that they should be read as soon as practicable.

I think that the matter of filter paper should be taken up next year, and a standard filter paper specified. There are undoubtedly differences that might be traced to different kinds of paper being used.

Some of the members of the Committee have suggested that there may be a difference in color readings on a very bright day and one that is dark and cloudy and also that it is difficult to match colors at night. It might be well to specify that oils be read, say, between nine and three.

I have heard the idea expressed that there may be a difference in the color of oil that comes through the filter at first and later. This would bear investigation, too.

One member has brought up the question of different quality of the color of light given off at different parts of the blue lamp. Another important question that should be investigated.

It seems to be the opinion of the Committee that we recommend that:

The Greiner or some modification of it, or the Bailey Tintometer be made standard.

Not more than three glasses be used.

The ¾ inch glass tube be used rather than the 4 oz. sample bottle.

The 75 watt lamp be used instead of the 150 watt one.

I wish to take this occasion to thank all the members of the Committee for their co-operation and the promptness with which they did what was asked of them.

The Color Committee of the A. O. C. S.

J. D. Evans, Chairman
G. Worthen Agee
H. E. Brownfield
J. C. Burt
Garry G. Grant
J. Pelofsky.

Report of Cake Color Committee

IN November, 1926, this committee proposed two possible procedures for making the color comparison of cake or meal samples with the official standards prescribed in Interstate Rule 102. Method I of the 1926 report was based upon the use of a rotating glass cup and Method II of the same report was substantially the same as the detailed method recommended herein and referred to in the tables as the "unaided eye" method.

These two methods and a third method, based upon use of a weak lens out of focus so as to blur individual particles of meal, have been tried on a number of samples by different observers and the gradings compared. Analysis of the results discloses no substantial advantage of method I (rotating cup) over the simpler Method II and no advantage at all in favor of the method using a weak lens out of focus, in spite of the fact that the individual observer may feel more confident of his judgments when using the rotating cup or a lens. Therefore the committee recommends official adoption of the simpler method with the rotating cup method as optional. Specifically, the following rule is proposed for making the color comparison:

"a. Meal. The meal to be graded should be placed in the center of a gray sheet or board at least eight inches square; it should be flattened out to make a level circle about three or four inches across, and a clean, one-inch square of the color standard laid on the center of the meal. The meal and standard, lying in a horizontal plane, should then be observed, in good daylight, from a position directly above them and at least 36 inches distant. For making close decisions, it is best to lay the board on the floor and observe it from a standing position directly above. To be graded 'prime' the meal must be as light or a lighter shade than the standard. If darker, it must be graded 'off' in color.

"Optionally, use may be made of a horizontal rotating cylinder of clear glass, containing meal at the bottom and a strip of color standard above the meal, both lying in close contact with the inner glass surface. The width of color standard, also of the band of meal exposed to view, should be not less than about one inch. The inside diameter of the cup should be about two inches. All gradings should be made in good daylight with a speed of rotation sufficient to blur the individual particles of meal.

"b. Cake. A representative portion of the cake to be graded should be ground so that 85 per cent will pass a 20-mesh screen. Portions of sample used for screen test should not be used for color comparison. The ground sample should be graded as for meal.

"Note: Any samples of meal containing coarse particles should be ground to the standard for cake and this fact should be stated in the report."

Two sets of observations have been made, those in table 1 by widely scattered observers and those in table 2 by observers independently recording gradings at the same time in the same laboratory. All samples recorded in table 1 were selected by the chairman either as obviously difficult or as disputed cases. Likewise six of the samples in table 2 were selected as difficult meals to grade. It seemed useless to study the grading of any large proportion of samples obviously prime or off.

TABLE 1.

Sample No.	I. Rotating Cup Observer				II. Unaided Eye Observer				III. Lens Observer			
	1	2	3	4	1	2	3	4	1	2	3	4
1	off	..	..	off	off	off	off	off	off	pr	off	off
2	off	..	..	off	off	off	off	off	off	off	off	off
3	off	..	..	off	off	pr	pr	pr	off	pr	pr	pr
4	pr	..	..	off	pr	pr	pr	pr	pr	pr	pr	pr
5	off	..	..	off	off	off	off	off	off	pr	pr	pr
6	off	..	..	off	off	pr	pr	off	off	pr	pr	off
7	off	..	..	off	off	off	pr	pr	off	pr	pr	pr
17	pr	..	..	pr	pr	pr	pr	pr	pr	pr	pr	pr
18	pr	..	..	pr	off	pr	pr	pr	off	pr	pr	pr
20	off	..	..	off	off	off	off	off	off	off	off	off

TABLE 2

Sample No.	I. Rotating Cup Observer			II. Unaided Eye Observer			III. Lens Observer		
	1	2	3	1	2	3	1	2	3
1	off	off	off	off	off	off	off	off	off
2	off	off	off	off	off	off	off	off	off
3	off	off	pr	off	pr	pr	off	off	pr
4	off	off	pr	off	off	pr	off	off	pr
5	pr	pr	pr	pr	pr	pr	pr	pr	pr
6	off	off	pr	off	off	pr	off	off	pr
7	pr	pr	pr	pr	off	pr	pr	off	pr
8	pr	pr	pr	pr	pr	pr	pr	pr	pr
9	pr	pr	pr	pr	pr	pr	pr	pr	pr
10	pr	pr	pr	pr	pr	pr	pr	pr	pr
11	pr	pr	pr	off	off	pr	pr	off	pr
12	off	off	off	off	off	off	off	off	off
13	off	off	off	off	off	off	off	off	off
14	off	pr	pr	off	pr	pr	off	pr	off
15	off	off	off	off	off	off	off	off	off
16	pr	off	pr	off	off	pr	off	off	pr
17	off	off	off	off	off	off	off	off	off
18	pr	pr	pr	pr	pr	pr	pr	off	pr
19	pr	pr	pr	pr	pr	pr	pr	pr	pr
20	off	off	off	off	off	off	off	off	off
21	off	off	pr	off	off	pr	off	off	pr

N. C. HAMMER
T. C. LAW
J. R. MAYS, JR.
A. S. RICHARDSON, Chairman.

Report of Committee on Crude Mill Operations

BY ANDREW K. SCHWARTZ, CHAIRMAN

A PRELIMINARY survey of cooking methods to determine if the cooking process had any material effect upon the quality of crude produced was the object of this year's investigation by this committee.

The first work was undertaken with French continuous or stack cookers. It is not reported here because it was found that seed storage conditions were such that the variation of seed made comparative tests impossible. Then too this type of cooker requires a long time for adjustment, which accentuated the difficulty of obtaining a uniform seed.

The experiments reported here were made in the Houston Cotton Oil Mill, an eight-press Mill using four Smith Vaile Open Cookers.

Origin of Seed: All Cotton Seed used had their origin in South Texas, and are what is commonly called Valley seed. They were upon arrival at the Mill dry prime seed and were stored for about four months before being milled.

Description of Cooking Unit: The cooking unit consisted of a jacketed conveyor, schutes or bins above the cookers and cookers proper. The ground seed dropped from the rolls into a conveyor, which fed an elevator. This conveyor was equipped with both a water and steam nozzle so that moisture could be added in either form. From the elevator the seed passed through the jacketed conveyor into a distributing conveyor feeding the cooker bins where the meats remained from one-half to one hour being charged into the cooker.

The jacketed conveyor was 22 feet long, 17 inches wide, having a heating surface of 49 square feet. At 50 pounds steam pressure the heat applied by this conveyor raised the seed temperature about 15 degrees Fahrenheit.

The cookers proper were 64 inches inside diameter, 26 inches deep, having a heating surface of 58.6 square feet. The meat charge when loaded to 4 inch outage was enough to fill four presses or approximately 1300 pounds. Each cooker was equipped with a half inch steam line for application of direct steam.

Pressing: In all experiments reported the conditions of pressing were constant. The meats were loaded into the presses in cakes weighing approximately 22 pounds. Each press was loaded with 15 cakes. Low pressure was applied for about one minute before the high pressure took effect. Maximum pressure of 4,000 pounds was reached in 7 minutes. The total time under pressure was 18 minutes. The schedule of the presses was 24 minutes.

Sampling: The following samples were taken:

1. Delinted seed before hullers.
2. Rolled meats after moisture addition, if any.
3. Cooked meats leaving cooker.
4. Cake.
5. Oil.

1. Delinted seed sample was taken continuously by hand from a conveyor during a period so

timed that the same seed was sampled that afterward arrived in a definite cooker. These seed were previously delinted of 108 pounds of lint per ton of seed worked.

2. and 3. Rolled and cooked meats were sampled in the same manner as delinted seed. Samples were preserved in friction top cans until quartered and analyzed twenty-four hours later.

4. Cake samples were taken as follows: All the cake from one press representative of the test was quartered, a different quarter being taken from succeeding cakes. These cakes were broken and ground to a pea sized meal. The mixture was quartered to about ten pounds. This meal was finely ground and quartered to analysis size.

5. Oil sample was taken by catching all the oil flowing from the press from which the cake sample was taken. This was mixed and reduced to two gallon size. A portion of this oil was filtered through a coarse filter paper to remove any coarse particles of meal present. The oil was then analyzed.

Ten samples of oil, when filtered in this manner, were compared for refining loss with the unfiltered oil with the following average results:

	Filtered	Uufiltered	Maximum Variation
Per cent loss.	6.08	6.01	0.5
Color	35 Y 4.80 R	35 Y 4.99 R	1.0 R

It was found that the results of the unfiltered oil bore the same relation to one another that did the filtered oil.

Other Conditions: Temperature of cooked meats as given in the experimental data was taken by immersion of a thermometer in 15 pounds of meats after discharged from cooker. This temperature did not agree with that shown by a thermometer placed in a well which in turn was partially immersed in the meats within the cooker.

As a comparison indicating the difference; the temperature caught as is recorded in the tables was 205° F. That shown by a thermometer placed in the cooker was at different intervals as follows:

2	min.	after	loading	175	degrees
5	"	"	"	180	"
8	"	"	"	193	"
12	"	"	"	208	"
17	"	"	"	215	"
22	"	"	"	217	"
28	"	"	"	218	"
35	"	"	"	218	"

The temperature of the direct steam entering the cooker was considerably higher than any of the temperatures given above.

The figure given as the quantity of direct steam entering the cooker was calculated assuming atmospheric pressure to exist in the cooker.

Color of meal is reported comparatively assigning the lowest number to the highest colored meal.

Analysis: All analyses were made according to the official method except the refining test where one sample of each set of tests was refined with these different lyes and the whole set refined with the lye giving best results.

For neutral oil test the Wesson method was employed.

Object of and Conclusion of Experiment No. 1

The object of Experiment No. 1 was to determine if the use of a slight preheating of seed without

previous addition of water had any effect upon the crude oil.

It was found that in all of these comparative tests the preheated meats gave a better oil extraction as indicated by a lower standard. This decrease in standard averaged four points. Change in quality of crude oil produced occurred. The loss on refining showed no con-

EXPERIMENT NO. 1

CONDITIONS

	1A	1B	2A	2B	3A	3B	4A	4B
Time of Cook Min.	40	40	40	40	40	40	40	40
Temp. of Cook ° F.	202	204	206	205	205	205	212	210
Jacket Pressure Lbs..	30	30	30	30	None		30	30
Rate of Direct Steam Addition Lbs. per min.	27	27	83	83	83	83	83	83
Pressure of Direct Steam.	110	110	110	110	110	110	110	110
Form of Moisture Addition before preheater	None				None			
Temp. of Preheated Seed.	120	107	120	107	128	115	128	118
Pressure on Preheater.	50		50		65		65	

SEED ANALYSIS

	1A	1B	2A	2B	3A	3B	4A	4B
% H_2O	9.0	9.8	9.1	9.1	8.5	8.5	8.7	8.4
% Oil	20.35	21.18	20.80	20.35	19.55	19.76	18.98	20.01
% NH_3	4.17	4.20	4.30	4.13	4.48	4.41	4.47	4.59
% FFA in Oil in Sd.	1.25	1.55	1.15	2.10	1.85	1.15	1.55	1.10
% Damage	1	4	1	2	4	2	0	0
% Immature	1	1	2	3	0	0	6	2

MEATS ANALYSIS

	1A	1B	2A	2B	3A	3B	4A	4B
% NH_3 Before Cook	5.73	5.70	5.73	5.63	6.60	6.38	6.63	6.27
% H_2O Before Cook	8.1	7.9	8.2	7.9	7.0	7.1	7.2	7.2
% H_2O After Cook	8.0	8.8	8.3	8.9	9.8	10.0	7.3	7.4

CAKE ANALYSIS

	1A	1B	2A	2B	3A	3B	4A	4B
% H_2O	7.9	8.6	8.0	7.7	10.7	10.4	7.7	9.0
% Oil	5.60	6.00	5.65	6.02	7.32	7.16	8.04	8.25
% NH_3	7.67	7.61	7.57	7.60	8.67	8.28	8.51	8.23
Standard	73.0	78.8	74.7	79.2	84.4	86.4	94.5	99.7
Color No.	2	1	2	1	1	2	1	2

REFINING TEST

	1A	1B	2A	2B	3A	3B	4A	4B
% NaOH Solution	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Degree Baume	14	14	14	14	14	14	14	14
% Loss	5.4	5.1	5.1	5.2	5.5	5.4	6.6	6.2
Color—Yellow	35	35	35	35	35	35	35	35
Color—Red	6.0	5.8	6.0	5.5	6.2	5.5	5.3	5.0
3% Official Earth Bleach—Yel.	20	20	20	20	20	20	20	20
3% Official Earth Bleach—Red	2.6	2.5	2.5	2.3	2.9	2.7	2.5	2.5

OIL ANALYSIS

	1A	1B	2A	2B	3A	3B	4A	4B
% F.F.A.	1.29	1.31	1.32	1.39	1.51	1.37	1.55	1.40
Color 1 in. cell—Yel.	50	50	50	50	50	50	50	50
Color 1 in. cell—Red	30.0	27.0	26.0	29.0	55.0	47.0	57.0	50.0
% H_2O	.06	.08	.10	.07	.08	.08	.12	.10
% Gums	.59	.41	.52	.55	.70	.65	.90	.91
% Neutral Oil	98.06	98.20	98.06	97.99	97.71	97.90	97.43	97.59

sistent tendency either to increase or decrease. Although there was an average increase in loss of 0.2% for the four comparisons, the color of refined and bleached oil was worse in every case where preheating was employed averaging 0.4r increase in refined and about 0.1r in bleached color.

Remarks: All soaps produced in refining were firm. The meats of test 3a, when subjected to pressure in press, showed a slight squeezing action.

EXPERIMENT NO. 2

CONDITIONS	1A	1B	1C	2A	2B	2C	3A	3B	4A	4B
Time of Cook Min.	40	40	40	40	40	40	40	40	40	40
Temp. of Cook ° F.	195	207	213	223	231	221	202	206	212	213
Jacket Pressure Lbs.	30	30	30	70	70	70	30	30	70	70
Rate of Direct Steam Addition Lbs. per min.	0	10	20	19	38	57	27	83	27	83
Pressure of Direct Steam	0	30	30	70	70	70	110	110	110	110
Form of Moisture Addition Before Preheater.		Dry		Dry		Dry		Dry		
Temp. of Preheated Seed.				None						
Pressure on Preheater.				None						
SEED ANALYSIS										
% H_2O	8.8	8.2	9.5	8.5	8.6	8.5	9.0	9.1	9.3	9.7
% Oil	20.16	19.95	19.60	19.75	19.79	21.34	20.35	20.80	21.20	20.80
% NH_3	4.22	4.27	4.31	4.31	4.40	4.36	4.17	4.30	4.09	4.16
% FFA in Oil in Seed	1.45	0.95	0.95	0.80	1.05	0.95	1.25	1.15	1.30	1.40
% damage	5	0	5	0	0	0	1	2	3	1
% Immature	1	2	2	1	2	5	1	2	2	1
MEATS ANALYSIS										
	1A	1B	1C	2A	2B	2C	3A	3B	4A	4B
% NH_3 Before Cook	6.25	6.21	6.31	6.03	6.08	6.08	5.73	5.73	5.60	5.78
% H_2O Before Cook	8.1	8.1	8.3	7.8	7.5	7.8	8.1	8.2	7.9	7.6
% H_2O After Cook	6.5	7.2	7.8	6.2	5.1	6.4	8.0	8.3	7.3	7.7
CAKE ANALYSIS										
% H_2O	7.2	6.9	7.4	6.8	6.3	6.6	7.9	8.0	7.3	7.3
% Oil	8.49	7.67	6.83	6.26	5.97	6.11	5.60	5.65	5.86	6.00
% NH_3	8.45	8.43	8.48	8.10	8.18	8.13	7.67	7.57	7.53	7.75
Standard	101.5	91.0	80.6	77.3	73.0	75.2	73.0	74.7	77.8	77.5
Color No.	1	2	3	1	2	3	2	1	2	1
REFINING TEST										
% NaOH Solution	7.6	7.6	7.6	8.8	8.8	8.8	7.0	7.0	7.0	7.0
Degree Baume	16	16	16	14	14	14	14	14	14	14
% Loss	6.8	6.0	5.7	6.2	6.0	5.5	5.4	5.1	5.8	5.4
Color—Yellow	35	35	35	35	35	35	35	35	35	35
Color—Red	4.2	5.0	4.4	4.5	4.5	4.4	6.0	6.0	5.5	5.0
3% Official Earth Bleach—Yellow	20	20	20	20	20	20	20	20	20	20
3% Official Earth Bleach—Red	1.8	2.0	1.8	2.0	2.0	2.0	2.6	2.5	2.2	2.2
OIL ANALYSIS										
	1A	1B	1C	2A	2B	2C	3A	3B	4A	4B
% F.F.A.	1.55	1.45	1.32	1.25	1.20	1.25	1.29	1.32	1.57	1.40
Color 1 in. Cell—Yel.	50	50	50	50	50	50	50	50	50	50
Color 1 in. Cell—Red.	47.0	34.0	27.0	41.0	42.0	42.0	30.0	26.0	50.0	43.0
% H_2O	.06	.07	.07	.09	.08	.06	.06	.10	.10	.06
% Gums	.60	.42	.39	.57	.56	.56	.59	.52	.58	.40
% Neutral Oil	97.79	98.06	98.22	98.09	98.16	98.13	98.06	98.06	97.75	98.14

Object of and Conclusion of Experiment No. 2

The tests of Experiment No. 2 were made to determine the effect of the continuous addition of direct steam, during the cooking process, or unmoistened meats.

It was found that such addition effected the standard of extraction, but little, except where low jacket pressure and small quantities of dried steam were employed in which case the improved extraction may be accounted for by insufficient application of heat. This probability is further indicated by the high standards under these conditions.

The quality of crude was materially changed by direct steam application. The losses were consistently lowered in these tests averaging a 0.6% improvement between maximum and minimum application. The color of refined and bleached oils remained materially the same. The color of crude oil appeared lighter where steam was applied.

Object of and Conclusion of Experiment No. 3

By the production of 41.8% and 48.7% protein meals it was sought to determine if increased addition of hulls detrimentally affected the oil. If anything the reverse appears to be the case.

EXPERIMENT NO. 3

CONDITIONS

	1A	1B
Time of Cook Min.	40	40
Temp. of Cook ° F.	221	221
Jacket Pressure Lbs.	70	70
Rate of Direct Steam Addition Lbs. per min.	57	57
Pressure of Direct Steam	70	70
Form of Moisture Addition before Preheater.	Dry	Dry

SEED ANALYSIS

% H_2O	8.5	8.5
% Oil	21.34	19.65
% NH_3	4.36	4.33
% FFA in Oil in Sd.	0.95	1.20
% Damage	0.	0.
% Immature	5	1

MEATS ANALYSIS

% NH_3 Before Cook	6.08	7.03
% H_2O Before Cook	7.8	7.6
% H_2O After Cook	6.4	5.4

CAKE ANALYSIS

% H_2O	6.6	6.8
% Oil	6.11	7.38
% NH_3	8.13	9.47
Standard	75.2	77.9
Color No.	2	1

REFINING TEST

	1A	1B
% NaOH Solution	8.8	8.8
Degree Baume	14	14
% Loss	5.5	6.4
Color	35Y 4.4R	35Y 4.8R
3% Official Earth bleach	20Y 2.0R	20Y 2.0R

OIL ANALYSIS

% F.F.A	1.25	1.38
Color one inch cell	20Y 42.0R	50Y 55.0R
% H_2O	.06	.10
% Gums	.56	.54
% Neutral Oil	98.13	97.98

Object of and Conclusion of Experiment No. 4

With addition of moisture in the form of steam before cooking and without only moisture addition it was sought to determine the effect of increased cooking time.

It was found that if sufficient moisture was present increased cooking time improved the extraction as represented by the standard of meal; to decrease the loss on refining; to darken the color of refined and bleached oil and to lighten the color of crude oil.

EXPERIMENT NO. 4

CONDITIONS	1A	1B	1C	2A	2B	2C	3A	3B	4A	4B
Time of Cook Min.	25	45	75	25	45	75	35	70	35	65
Temp. of Cook ° F. ...	194	208	210	205	217	230	213	238	205	205
Jacket Pressure Lbs...	30	30	30	75	75	75	70	70	None	
Rate of Direct Steam-Addition Lbs. per min.	30	30	30	67	67	67	83	83	83	83
Pressure of Direct Steam.	30	30	30	75	75	75	110	110	110	110
Form of Moisture Addition before Preheater	Steam		Steam		Steam		Dry	Dry	Dry	Dry
Temp. of Preheater Seed	150	150	150	150	150	150	—	—	—	—
SEED ANALYSIS										
% H_2O	9.2	9.3	9.0	8.8	8.9	9.0	8.7	9.0	8.5	8.7
% Oil	20.28	19.85	19.81	20.90	20.08	20.30	20.80	21.01	19.76	19.82
% NH_3	4.38	4.39	4.41	4.41	4.44	4.46	4.16	4.26	4.46	4.43
% FFA in Oil in Seed	1.40	1.25	1.20	1.50	1.05	1.20	1.40	1.05	1.15	1.45
% Damage	1	0	1	1	0	0	1	1	1	0
% Immature	2	2	3	1	4	4	1	2	1	4
MEATS ANALYSIS										
% NH_3 Before Cook ..	6.23	6.23	6.26	6.28	6.23	6.38	5.78	5.68	6.33	6.27
% H_2O Before Cook ..	10.7	9.8	10.1	9.2	9.1	9.7	7.6	7.8	7.1	7.5
% H_2O After Cook....	9.5	7.6	6.6	8.4	6.3	6.9	7.7	4.4	10.0	9.7
CAKE ANALYSIS	1A	1B	1C	2A	2B	2C	3A	3B	4A	4B
% H_2O	10.4	9.1	8.6	9.3	7.7	6.2	7.3	5.2	10.4	10.4
% Oil	6.86	5.83	5.81	6.80	6.04	5.66	6.00	6.74	7.16	7.39
% NH_3	8.70	8.83	8.83	8.80	8.83	8.85	7.75	7.74	8.28	8.16
Standard	78.9	66.0	65.8	77.3	68.4	64.0	77.5	87.1	86.4	90.6
Color No.	1	3	2	1	2	3	2	1	2	1
REFINING TEST										
% NaOH solution ...	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Degree Baume	14	14	14	14	14	14	14	14	14	14
% Loss	9.0	8.5	8.8	9.7	9.1	8.8	5.4	5.8	5.4	5.8
Color—Yellow	35	35	35	35	35	35	35	35	35	35
Color—Red	5.5	5.8	5.7	5.4	5.5	6.0	5.0	5.8	5.5	6.3
3% Official earth bleach —Yellow	20	20	20	20	20	20	20	20	20	20
3% Official earth bleach —Red	2.5	2.7	2.5	2.4	2.5	2.6	2.2	2.5	2.7	3.0
OIL ANALYSIS										
% F. F. A.....	1.60	1.45	1.50	1.50	1.42	1.42	1.40	1.38	1.37	1.56
Color 1 in. cell—Yellow	50	50	50	50	50	50	50	50	50	50
Color 1 in. cell—Red...	42.0	26.0	...	46.5	27.0	22.0	43.0	32.0	47.0	68.0
% H_2O	.07	.08	...	.09	.13	.07	.06	.08	.08	.09
% Gums	.44	.33	...	.52	.52	.49	.40	.66	.65	.71
% Neutral oil	97.89	98.14	...	97.89	97.93	98.02	98.14	97.88	97.90	97.64

Where no moisture is added the length of cooking time is limited and an increase of time decreases the extraction, increases the loss on refining and reddens both refined and bleached oils, but lightens the color of crude.

Test No. 4 was made using direct steam only for application of heat. The effect on oil and extraction was the same as where unmoistured seed were employed except that the color of crude was darkened by increased time.

Remarks: The loss on refining when steam is added before cooking is abnormally high due to the effect of exposure of ground meats to moisture and high temperature for about three quarters of an hour. All soaps from these refinings were unfirm. (See Experiment Nos. 5 and 6). In the refining of Nos. 1A, 1B and 1C, and 2A, 2B and 2C, it was apparent that the longer cooking gave an oil which broke quicker on refining and soap particles finer in size and lighter in color. The soaps from refinings 3A, 3B, 4A and 4B were all firm. No. 1A squeezed from press. No. 3B was too dry (over cooked) cake fell from press cloth. Nos. 4A and 4B showed slight squeezing action in press.

Object of and Conclusion of Experiment No. 5

The object of Experiment No. 5 was to determine if the form of moisture, whether employed as steam or as water, introduced before cooking, effected the refining loss. These tests were carried on with and without the addition of direct steam into cookers.

In each case the introduction of direct steam into the cooker improved the meal standard of extraction. The introduction of water before the cookers increased the loss on refining about 0.6%, darkened the refined color about 0.3r, while steam increased the loss 2.8% and darkened the refined color 0.8r. The bleach on oil remained the same in all cases.

The addition of steam before the cookers preheated the meats to about 150°. The addition of water without any preheat shows no increase in refining loss. (See Experiment No. 7). In this Experiment the increase of loss on water addition was due to the cuse of the preheater. (See Experiment No. 1).

The addition of steam shows increasing loss as the wetted meats are allowd to stand for a longer time. (See Experiment No. 6).

The increase in loss shown by steam wetted meats is due to the combined action of water, increased temperature and time of standing before the cook.

Steam offers no advantage over water with regard to standard of extraction.

Remarks: Soaps from refinings 3A and 3B were soft. All other soaps were firm, gave up no oil on remelting and the refined oil could be easily poured from them.

EXPERIMENT NO. 5

CONDITIONS	1A	1B	2A	2B	3A	3B
Time of cook min.	40	40	40	40	40	40
Temp. of cook °F.	209	210	204	210	210	209
Jacket pressure lbs.	45	45	45	45	45	45
Rate of direct steam addition lbs. per min....	..	45	..	45	..	45
Pressure of direct steam	..	45	..	45	..	45
Form of moisture addition before preheater	Dry	Dry	Water	Water	Steam	Steam
Temp. of preheated seed	115	115	115	115	160	160
Pressure on preheater	45	45	45	45	45	45

(*Table 5—Continued*)

SEED ANALYSIS						
% H_2O	9.1	..	8.8	..	8.1	..
% Oil	20.90	..	20.27	..	20.38	..
% NH_3	4.48	..	4.44	..	4.44	..
% FFA in oil in seed	0.95	..	1.30	..	0.85	..
% Damage	1	..	0	..	0	..
% Immature	1	..	0	..	1	..
MEATS ANALYSIS						
% NH_3 before cook	6.18	6.18	6.08	6.08	6.28	6.14
% H_2O before cook	8.3	8.6	9.4	10.1	8.9	9.2
% H_2O after cook	7.0	6.5	7.9	6.6	6.6	7.0
CAKE ANALYSIS						
% H_2O	7.5	8.5	8.6	8.8	8.5	7.9
% Oil	6.65	5.98	6.25	5.69	6.07	5.68
% NH_3	8.38	8.39	8.37	8.36	8.48	8.40
Standard	79.3	71.2	74.7	68.0	71.6	67.6
Color No.	1	2	6	5	3	4
REFINING TEST						
% NaOH solution	6.2	6.2	6.2	6.2	6.2	6.2
Degree Baume ...	14	14	14	14	14	14
% Loss	5.1	5.1	5.8	5.6	8.0	7.8
Color	35Y 4.1R	35Y 4.1R	35Y 4.3R	35Y 4.5R	35Y 4.8R	35Y 5.0R
3% official earth bleach	20Y 1.7R	20Y 1.7R	20Y 1.7R	20Y 1.7R	20Y 1.7R	20Y 1.8R
OIL ANALYSIS						
%F.F.A.	1.03	.99	1.00	1.00	1.05	1.06
Color 1 in. cell...	50Y 26.0R	50Y 21.0R	50Y 21.0R	50Y 23.0R	50Y 18.0R	50Y 26.0R
% H_2O	.06	.05	.08	.10	.10	.09
% Gums	.40	.35	.47	.66	.52	.59
% Neutral oil....	98.51	98.61	98.45	98.24	98.33	98.26

Object of and Conclusion of Experiment No. 6

This Experiment had for its object to determine if the time elapsed between addition of moisture to ground meats and the beginning of the cook had any influence on the quality of oil produced.

It was found that by allowing the moistened meats to stand one hour in the bins the loss was increased 2.1%, while the refined and bleached color remained the same. The high standard of the meat run directly to the cooker without any storage time in the bins is as yet unaccounted for.

EXPERIMENT NO. 6

CONDITIONS	1A	1B		1A	1B
Time of Cook Min.....	40	40	Rate of Direct Steam Addition Lbs. Per Min.....	83	83
Temp. of Cook ° F.....	207	212	Pressure of Direct Steam..	110	110
Jacket Pressure, lbs.....	40	40	Temp. of Preheat ° F.....	165	165
Minutes Allowed to Stand in Cooker Bins.....	60	0	Form of Moisture Addition Before Preheater.....	Steam	Steam

(*Table 6—Continued*)

SEED ANALYSIS

% H_2O	8.5	8.4	% FFA in Oil in Seed	1.40	1.20
% Oil	19.62	20.12	% Damage	1	0
% NH_3	4.32	4.32	% Immature	1	1

MEATS ANALYSIS

% NH_3 Before Cook	6.08	6.08	% H_2O After Cook	6.4	6.2
% H_2O Before Cook	9.0	8.6			

CAKE ANALYSIS

% H_2O	7.5	7.9	Standard	70.3	90.4
% Oil	6.00	7.51	Color No.	2	1
% NH_3	8.53	8.31			

REFINING TEST

% NaOH Solution	7.0	7.0	Color	35Y 5.7R	35Y 5.8R
Degrees Baume	14	14	3% Official Earth Bleach	20Y 2.8R	20Y 2.7R
% Loss	9.1	7.0			

OIL ANALYSIS

% FFA	1.71	1.61	% Gums	.68	.66
Color 1 in. Cell	..	..	% Neutral Oil	97.54	97.67
% H_2O	.06	.07			

EXPERIMENT NO. 6A

In order to account for the excess loss of test 1A over 1B in Experiment No. 6, two additional refinings were made some time later on the oils of these two tests; the soap stocks analyzed and the loss divided into its constituent parts.

	1A	1B		1A	1B
% F.F.A.	1.60	1.55	% Loss Due to F.F.A.	1.60	1.55
% Lye	7.0	7.0	% Loss Due to Materials Not Fat	1.20	.80
Degree Baume	14	14			
% Loss	9.8	6.4	% Loss Due to Saponification	2.02	2.49
% Moisture in Soapstock	39.01	47.80			
% Neutral Oil in Soapstock	29.64	11.75	% Loss Due to Neutral Oil Emulsified	4.98	1.56
% T.F.A. in Soapstock	51.24	41.75			
% NaOH in Soapstock	3.61	4.68	Analyzed Loss Not Fat	1.40	1.09

The excess loss is due to the presence of some emsulsifying agent.

Object of and Conclusion of Experiment No. 7

Experiment No. 7 was performed to determine the effect of the addition of water to meats before cooking under two cooking conditions employing 30 and 70 pounds jacket pressure. The experiment shows that when using 30 pounds jacket pressure the best extraction is obtained when the moisture content of meats was raised to 10%. The loss on refining decreased as water addition increased.

Employing 70 pounds jacket pressure the best extraction was obtained by increasing the moisture in meats to about 9%, although here the variation in standard was very little. The quality of crude showed improvement over that produced from unwetted meats, but showed no variation with increasing moisture content.

EXPERIMENT NO. 7

CONDITIONS	1A	1B	1C	2A	2B	2C
Time of cook min.	40	40	40	40	40	40
Temp. of cook ° F.	209	209	205	214	215	215
Jacket pressure lbs.	30	30	30	65	65	65
Rate of direct steam addition lbs. per min.	83	83	83	83	83	83
Pressure of direct steam	110	110	110	110	110	110
Form of moisture addition before preheater	Dry	Water	Water	Water	Water	Water
Temp. of preheated seed	None	None	None	None	None	None
SEED ANALYSIS						
% H_2O	8.8	8.8	8.8	8.3	8.0	8.3
% Oil	19.65	20.50	20.34	19.52	19.80	20.22
% NH_3	4.38	4.40	4.40	4.35	4.36	4.45
% F.F.A. in oil in seed	1.15	1.50	1.15	1.70	1.30	1.75
% Damage	0	0	0	2	0	2
% Immature	2	2	6	2	3	0
MEATS ANALYSIS						
% NH_3 before cook	6.13	6.28	6.05	8.45	6.33	6.48
% H_2O before cook	7.2	10.1	12.3	8.7	10.2	11.0
% H_2O after cook	6.8	9.1	10.9	6.3	7.5	7.8
CAKE ANALYSIS						
% H_2O	7.0	9.3	10.0	7.2	7.5	7.8
% Oil	9.10	6.20	6.96	6.05	6.16	6.34
% NH_3	8.59	8.67	8.53	8.88	8.90	8.83
Standard	105.8	71.5	81.5	68.1	69.3	71.8
Color No.	1	2	3	1	2	3
REFINING TEST						
% NaOH solution	7.0	7.0	7.0	7.0	7.0	7.0
Color	35Y 5.7R	35Y 5.7R	35Y 5.6R	35Y 6.2R	35Y 6.2R	35Y 6.2R
Degree Baume	14	14	14	14	14	14
% Loss	6.8	6.0	5.4	6.4	6.4	6.3
3% official earth bleach	20Y 2.7R	20Y 2.8R	20Y 2.7R	20Y 3.1R	20Y 3.0R	20Y 3.1R
OIL ANALYSIS						
% F.F.A.	1.65	1.42	1.29	1.73	1.64	1.67
Color 1 in cell	50Y 47.0R	50Y 41.0R	50Y 43.0R	50Y 76.0R	50Y 73.0R	50Y 83.0R
% H_2O	.09	.11	.08	.08	.06	.08
% Gums	.88	.69	.43	.90	.87	.84
% Neutral oil	97.37	97.78	98.20	97.29	97.43	97.41

Object of and Conclusion of Experiment No. 8

The object of Experiment No. 8 was to compare the use of high and low jacket pressure, or high and low temperature cooking.

The results show in all three cases a slightly lower loss that is in favor of the low jacket pressure.

Where water is added to the meats there is an improvement in color of oil and a slight decrease in extraction with the low jacket pressure. When the meats are cooked without previous addition of water the reverse is true.

EXPERIMENT NO. 8

	1A	1B	2A	2B	3A	3B
CONDITIONS						
Time of cook min.....	40	40	40	40	40	40
Temp. of cook ° F.....	202	212	206	213	209	215
Jacket pressure lbs.....	30	70	30	70	30	65
Rate of direct steam addition lbs. per min.....	27	27	83	83	83	83
Pressure of direct steam...	110	110	110	110	110	110
Form of moisture addition before preheater	Dry	Dry	Dry	Dry	Water	Water
SEED ANALYSIS						
% H_2O	9.0	9.3	9.1	8.7	8.8	8.0
% Oil	20.35	21.20	20.80	20.80	20.50	19.80
% NH_3	4.17	4.09	4.30	4.16	4.40	4.36
% F.F.A. in oil in seed...	1.25	1.30	1.15	1.40	1.50	1.30
% Damage	1	3	2	1	0	0
% Immature	1	2	2	1	2	3
MEATS ANALYSIS						
% NH_3 before cook.....	5.73	5.60	5.73	5.78	6.28	6.33
% H_2O before cook.....	8.1	7.9	8.2	7.6	10.1	10.2
% H_2O after cook.....	8.0	7.3	8.3	7.7	9.1	7.5
CAKE ANALYSIS						
% H_2O	7.9	7.3	8.0	7.3	9.3	7.5
% Oil	5.60	5.86	5.65	6.00	6.20	6.16
% NH_3	7.67	7.53	7.57	7.75	8.67	8.90
Standard	73.0	77.8	74.7	77.5	71.5	69.3
REFINING TEST						
% NaOH solution	7.0	7.0	7.0	7.0	7.0	7.0
Degree Baume	14	14	14	14	14	14
% Loss	5.4	5.8	5.1	5.4	6.0	6.4
Color 35Y 6.0R	35Y 5.5R	35Y 6.0R	35Y 5.0R	35Y 5.7R	35Y 6.2R	
3% official earth bleach...20Y 2.6R	20Y 2.2R	20Y 2.5R	20Y 2.2R	20Y 2.8R	20Y 3.0R	
OIL ANALYSIS						
% F.F.A.	1.29	1.57	1.32	1.40	1.42	1.64
Color 1 in. cell.....50Y 30.0R	50Y 50.0R	50Y 26.0R	50Y 43.0R	50Y 41.0R	50Y 73.0R	
% H_2O	.06	.10	.10	.06	.11	.06
% Gums	.59	.58	.52	.40	.69	.87
% Neutral oil	98.06	97.75	98.06	98.14	97.78	97.43

Object of and Conclusion of Experiment No. 9

The object of Experiment No. 9 was to determine if there was any difference in the oil flowing from the press at different stages of pressing.

The oil from the first and last stages was caught separately and compared with the total oil from another press filled from the same cooker. The results showed some difference in that the first oil gives a lower loss than the last flowing from the press.

EXPERIMENT NO. 9

	Number 1			Number 2		
	First Oil from Press	Last Oil from Press	Total Oil	First Oil from Press	Last Oil from Press	Total Oil
% F.F.A.	1.39	1.45	1.39	1.32	1.34	1.40
% H_2O	.07	.05	.07	.08	.10	.06
% Neutral oil	98.03	97.80	98.09	97.99	97.96	98.14
% Gums	.51	.70	.45	.61	.58	.40
% Lye	7.0	7.0	7.0	7.0	7.0	7.0
% Baume	14	14	14	14	14	14
% Loss	8.6	8.9	9.0	4.9	6.0	5.4
Color	35Y 5.7R	35Y 5.5R	35Y 5.5R	35Y 5.5R	35Y 5.3R	35Y 5.0R
Bleach	20Y 2.5R	20Y 2.4R	20Y 2.4R	20Y 2.2R	20Y 2.2R	20Y 2.2R

Discussion of Results

The experimental work given here is to be considered in the light of a preliminary survey to determine the advisability of further investigation. This Committee would hesitate at this time to advance any theories on the correct cooking of prime cottonseed meats. There are, however, a few points of interest brought out in this work.

In the experimental work above a neutral oil determination by Dr. Wesson's method is included. This method of analysis was not found of any particular value in predicting or accounting for the loss on refining. In some cases, as in Experiment No. 7, the loss on refining seemed to decrease with a decrease in materials not fat (reported as gums) and with increasing neutral oil content. In other experiments it fails or only slightly accounts for an increase of loss as much as 3%.

A comparison of titrated free fatty acid in oil produced in the mill from a certain seed with that shown by the oil extracted from the seed according to the official method showed close agreement. In 47 tests there were five perfect checks; nine within variation of .10; ten within .10 and .20; eleven within .20 and .30; seven within .30 and .40; three within .40 and .50; and two over 0.50%; with a maximum of variation of .71. Average showed F. F. A. Oil 1.41, F. F. A. seed 1.28.

No conclusions could be drawn as to all the factors determining the color of meal produced. This color is, however, greatly influenced by the amount of water added to the meats before cooking and to the method and amount of heat application.

It is seen that by variation of cooking methods or procedures within usual practical limits it is possible to get the same yield of oil and still have an oil varying as much as 3% in refining loss. The proper cooking of Cotton Seed Meats seems to be a process depending upon the regulation of several, variable such as moisture, in what form and when applied; the temperature attained by the meats; the rate and time of heating and the means of heat application.

The committee is of the opinion that this process offers a valuable field for investigation; that the work, if possible, should be reduced to a more absolute basis than reported in this survey and that it be continued on this and extended to other types of seed usually met with in oil milling.

Report of the Smalley Foundation Committee

Co-operative Meal Samples for the 1927-1928 Season

BY H. C. MOORE, CHAIRMAN

IN tables Nos. I to V following will appear a summary of the results of co-operative analytical work of the Smalley Foundation for oil and ammonia for the past year. This work was concluded with sample No. 30, reported on April 11, 1928. During this year 91 collaborators have participated, as compared to 81, 75, 78 and 88 for the four preceding years.

Table No. I gives the standing of the 42 collaborators who reported oil determinations on all samples. In the previous year 43 collaborators reported on all of the samples, as compared to 35, 29 and 36, respectively in the three preceding years.

In Table No. II appears the corresponding standing of the 63 collaborators who reported ammonia results on all samples. In the previous year 65 reported on all of the samples, as compared to 52, 42 and 50 in the three preceding years.

Table No. III gives the combined laboratory average standing for both oil and ammonia for the 42 collaborators who reported both oil and ammonia on all of the samples. In the previous year 43 collaborators reported oil and ammonia results on all samples, as compared to 34, 28 and 36 for the three preceding years.

Table No. IV gives the summary of the results of other collaborators who have failed to report on all samples, but whose results deserve recognition.

Table No. V gives briefly an idea of the range of agreement of results for oil and ammonia separately on the 30 samples. For example, the best general agreement among the collaborators for oil is found in the case of sample No. 12, and for ammonia on sample No. 11; likewise the poorest agreement among all collaborators for both oil and ammonia is in the case of sample No. 9. This table is interesting in showing the maximum, minimum and average number of collaborators in the case of oil and ammonia within the three ranges chosen for all samples.

The committee decided not to count sample No. 9 in the tabulation of results, as announced on the report for sample No. 15, so this year's average is based on 29 samples. The committee is generally opposed to eliminating any of the samples from the final tabulation, but the complaints on No. 9 came from so many of the collaborators, and further investigation indicated some justification for making an exception in this case, that the committee decided not to include it in the final tabulation. The results in Table V will tend to confirm the committee's judgment in this action.

The prize awards for the best work done on the 29 samples are the same as for the past several

years, and as published in the Cotton Oil Press in 1923. The winners of these awards for the past year are as follows:

The laboratory cup for the highest efficiency in the determination of both oil and ammonia is awarded to No. 78, E. H. Tenent, International Sugar Feed Co., Memphis, Tenn., whose average is 99.934 per cent. The certificate for second place is awarded to No. 77, L. B. Forbes Laboratories, Memphis, Tenn., whose average efficiency is 99.919½ per cent. The corresponding percentages for the two previous years were 99.899½ and 99.892½, 99.901 and 99.869, respectively.

The collaborators are reminded again that the present cup was generously furnished the Society by Dr. H. B. Battle of Montgomery, after he had won permanently the original cup, having won it on three different occasions. This year is the second award of this cup, being awarded the previous year to Dr. W. F. Hand, State Chemist, A. & M. College, Mississippi. The chairman believes that this present cup should be hereafter referred to as the Battle cup.

The certificate for the highest efficiency in the determination of oil is awarded to No. 78, E. H. Tenent, International Sugar Feed Co., Memphis, Tenn., whose average is 99.920 per cent, and the certificate for second place is awarded to No. 77, L. B. Forbes Laboratories, Memphis, Tenn., whose average is 99.895 per cent. The corresponding percentages for the two previous years were 99.878 and 99.852 per cent, and 99.871 and 99.786 per cent, respectively.

The two certificates for the highest efficiency in the determination of ammonia are awarded to No. 24, Southwestern Laboratories, Dallas, Texas, and No. 73, George K. Redding, The Larrowe Milling Co., Rossford, Ohio, who are tied for first place, their average efficiency being 99.979 per cent. The certificate for second place is awarded to No. 12, W. R. Austin, Armour Fertilizer Works, Nashville, Tenn., whose average is 99.965 per cent. The corresponding percentages for the two previous years were 99.996 and 99.988 per cent, and 99.966 and 99.966 per cent (tied for first place) and 99,956 second place, respectively.

In accordance with the resolution adopted by the American Oil Chemists' Society, the identity of the other collaborators will not be disclosed.

It will be observed from the foregoing that the percentage efficiency for oil and for the combined oil and ammonia work is higher than for last year, although the average for ammonia is slightly under last year's result.

The method for determining the standing of the various collaborators and their per cent efficiency is the same as has been used for several years past, and is fully described in the January, 1923, issue of the Cotton Oil Press, Vol. VI, No. 9, Page 33. The same rule also has been used as heretofore in calculating the accepted averages. As there have been several requests recently for a description of this method, it is given here as follows:

All results are listed in an ascending order from the lowest to the highest and a preliminary average calculated after omitting results which are obviously extreme. Next, all results within plus or minus 0.10 per cent from the preliminary average are taken and a new average called "A" is calculated. In other words, if 7.50 is

the preliminary average, then all results from 7.40 to 7.60 inclusive are taken. Next is found the largest number of results within the "A" group which are within a range of 0.10 per cent, (that is, say, 7.40 to 7.50 inclusive, 7.41 to 7.51 inclusive, or 7.45 to 7.55 inclusive, etc.) and the results in this group used to calculate average "B". The accepted average is the average of "A" and "B" taken to the nearest 0.01. In case this calculated average should be exactly half way between two values 0.01 apart, then the "B" result is favored, that is, in case the "A" result is 7.500 and "B" 7.510 and the average of "A" and "B" 7.505, the average would be 7.51.

It is hoped that there is no mistake in the results appearing in Tables I to V inclusive. These have been mostly double checked and yet as there are so many figures involved, there may be some slight error.

With the exception of Sample No. 9, there have been very few complaints on the samples, and the chairman feels that a vote of thanks and appreciation is due Thomas C. Law for his care and painstaking work in the preparation and handling of the samples. The collaborators generally probably do not realize the amount of work and care required for the proper handling of these samples. This work is done without profit, and if one's time is counted, is done at a distinct loss. An unselfish interest in the American Oil Chemists' Society and its collaborative work and a desire to be of service in its promotion is the motive power of this office.

The average of the efficiencies for both oil and ammonia on the 29 samples for the ten highest collaborators this year was 99.888, as compared to 99.862 for the previous year.

The average of all accepted results for oil for the 29 samples is 6.85 per cent. The similar average for the previous year was 7.63. The average number of points off in oil for the ten highest collaborators this year is 33.4 points and for the previous year 46.9 points. The average efficiency in oil for the ten highest collaborators was 99.832 and 99.795, respectively.

Likewise for the ammonia results, the average of the accepted values is 8.03 per cent. The similar average for the previous year was 8.16 per cent. The average number of points off for the ten highest collaborators this year is 10.5 points and for the previous year 8.1 points. The average efficiency in ammonia for the ten highest collaborators was 99.955 and 99.967 respectively.

An opportunity has been afforded all collaborators to be advised by wire collect, in case their reports are not received in time each week, or in case there seems to be a typographical error in their reports. Only 38 of the collaborators have taken advantage of this offer, while one or two others have been disappointed in finding their results omitted from some report. According to our rule, only results which are received up to and including Tuesday of each week are to be accepted; however all results which have been received up to Wednesday morning of each week before the final copy is sent to the printer have been accepted. These last results, however, have not been included in calculating the accepted average. It is possible that the number of results received after the average has been calculated might change the accepted average as much as 0.01 per cent, although

this condition would rarely arise.

This year's report of the Smalley Foundation shows much progress. More collaborators were enrolled than in any previous year, while the efficiency of the analysts is improving. The value of this work is unquestionable and is being more fully appreciated each year. The committee has requested no additional work from the collaborators this past year, and the foregoing summarizes the year's activity.

It should be noted again that the purpose of the Smalley Foundation is not to provide a contest to win a prize, but through co-operation to improve the quality and the standard of the analytical work of all analysts engaged in making oil and ammonia determinations. That it is succeeding in its purpose is shown by the continually increasing number of analysts participating in the collaborative analytical work and also by the improvement in the general agreement of their results, as shown by the annual reports for several years back. It is to be hoped that future years will show still more progress.

In concluding, the chairman wishes to thank the collaborators and the members of the committee for their co-operation, and to add that he feels this important work will be best served another year under the direction of a new chairman, and recommends such an appointment. He wishes to thank the American Oil Chemists' Society for the opportunity of serving in this capacity for a number of years past, and is grateful indeed if this service has helped in some measure in promoting this important work.

Personnel of committee: H. C. Moore, Chairman; C. A. Butt, L. B. Forbes, H. B. Battle, E. H. Tenent, M. G. Boulware.

TABLE I—Oil Results, All Samples

(Average analysis, Oil 6.85)

Rank	An. No.	Points off	Av. per sample	Efficiency
1	78	16	.0055	99.920
2	77	21	.0072	99.895
3	25	25	.0086	99.875
4	24	29	.0100	99.854
5	74	31	.0107	99.844
6	45	33	.0114	99.834
7	33	36	.0124	99.819
8	57	38	.0131	99.809
9	41	40	.0138	99.799
10	20	49	.0169	99.753
	23	49	.0169	99.753
12	73	59	.0203	99.704
13	3	68	.0234	99.658
14	49	73	.0252	99.632
15	39	75	.0259	99.622
16	21	76	.0262	99.618
17	61	85	.0293	99.572
18	6	86	.0297	99.566
19	37	88	.0303	99.558
20	2	90	.0310	99.547
21	55	91	.0314	99.542
22	22	95	.0327	99.523
23	52	100	.0345	99.496
24	67	109	.0376	99.451
25	85	111	.0383	99.441
26	43	124	.0428	99.375
27	8	126	.0434	99.366
28	89	129	.0445	99.350
29	38	132	.0455	99.336
30	46	148	.0510	99.255
31	84	152	.0524	99.235
32	70	160	.0552	99.194
33	68	177	.0610	99.110
34	7	182	.0627	99.085
35	4	192	.0662	99.034
36	71	218	.0752	98.903
37	40	259	.0893	98.696
38	82	260	.0896	98.692
39	42	298	.1028	98.499
40	58	339	.1169	98.292
41	63	439	.1514	97.790
42	91	497	.1714	97.498

TABLE II—Ammonia Results, All Samples

(Average analysis 8.03)

Rank	An. No.	Points off	Av. per sample	Efficiency
	(24	5	.0017	99.979
1	(73	5	.0017	99.979
3	12	8	.0028	99.965
4	(39	10	.0034	99.958
	(78	10	.0034	99.958
6	25	11	.0038	99.953
7	59	12	.0041	99.949
8	(41	13	.0045	99.944
	(77	13	.0045	99.944
10	(57	14	.0048	99.940
	(74	14	.0048	99.940
12	89	15	.0052	99.935
13	23	18	.0062	99.923
14	3	20	.0069	99.914
15	19	22	.0076	99.905
	(4	23	.0079	99.902
16	(20	23	.0079	99.902
	(33	23	.0079	99.902
19	(10	25	.0086	99.893
	(49	25	.0086	99.893
21	52	27	.0093	99.884
22	(2	28	.0097	99.879
	(75	28	.0097	99.879
24	45	30	.0103	99.872
25	(13	31	.0107	99.867
	(43	31	.0107	99.867
27	14	33	.0114	99.858
28	32	35	.0121	99.849
29	8	36	.0124	99.846
30	(21	37	.0128	99.841
	(44	37	.0128	99.841
32	(35	38	.0131	99.837
	(42	38	.0131	99.837
34	40	41	.0141	99.825
35	17	42	.0145	99.820
36	(11	44	.0152	99.811
	(38	44	.0152	99.811
	(55	44	.0152	99.811
39	22	45	.0155	99.807
40	85	46	.0159	99.802
41	91	47	.0162	99.798
42	(26	54	.0186	99.768
	(70	54	.0186	99.768
44	67	57	.0197	99.755
45	27	59	.0204	99.746
46	6	61	.0210	99.738
47	(37	62	.0214	99.734
	(82	62	.0214	99.734
49	84	64	.0221	99.725
50	15	66	.0228	99.716
51	65	67	.0231	99.713
52	51	70	.0241	99.700
53	(61	74	.0255	99.683
	(68	74	.0255	99.683
55	30	85	.0293	99.635
56	46	100	.0345	99.570
57	54	101	.0348	99.567
58	7	104	.0359	99.553
59	66	106	.0366	99.532
60	58	121	.0417	99.481
61	34	139	.0479	99.403
62	63	140	.0483	99.398
63	71	144	.0497	99.381

TABLE III—Oil and Ammonia Results, All Samples

Rank	Analyst	Efficiency
1	78	99.934
2	77	99.919½
3	24	99.916½
4	25	99.914
5	74	99.892
6	57	99.874½
7	41	99.871½
8	33	99.868
9	45	99.853
10	73	99.841½
11	23	99.838
12	20	99.833½
13	39	99.790
14	3	99.786
15	49	99.762½
16	21	99.729½
17	2	99.713
18	52	99.690
19	55	99.676½
20	22	99.665
21	6	99.652
22	37	99.646
23	89	99.642½
24	61	99.627½
25	85	99.621½
26	43	99.621
27	8	99.606
28	67	99.603
29	38	99.573½
30	70	99.481
31	84	99.480
32	4	99.468
33	46	**99.412½**
34	68	99.396½
35	7	99.319
36	40	99.260½
37	82	99.213
38	42	99.168
39	71	99.142
40	58	98.886½
41	91	98.648
42	63	98.584

TABLE IV—Results of Other Collaborators Whose Results Deserve Recognition

Analyst	No. samples reported on	Points off: Oil	Points off: Ammonia
1	23	...	33
5	26	280	99
16	28	...	89
18	25-27	299	51
28	21	...	82
29	28	249	82
31	28	...	23
36	28	...	65
47	20	134	302
50	28	127	97
54	28	186	*
64	28	...	99
69	26	214	34
80	26	...	75
83	28	...	107
87	26	455	58

*29 samples; reported in Table II.

TABLE V

	No. Collaborators reporting	No. Results ±.10	No. Results ±.05	No. Results ±.02	Sample No.
		OIL			
Max. uniformity	52	44	34	22	12
Min. uniformity	51	30	20	6	9
Average uniformity	51	40	30	15	..
		AMMONIA			
Max. uniformity	83	79	73	46	11
Min. uniformity	82	70	49	23	9
Average uniformity	80	77	65	40	..

The American Oil Chemists' Society

Notes and Correspondence

Standardization of Lovibond Glasses

(Investigation in Co-operation with A. O. C. S.)

Report for March, 1928

(Names in parentheses at ends of several sections of the report indicate individuals principally responsible for the work described.)

I. Continuation of Investigation of the Sixty-five 35-*Y Glasses Submitted by A.O.C.S. in August,* 1927.

A condensed report giving the final findings on these glasses is nearly ready. This report will give the following data for each of these glasses:

(1) The rigorous equivalent of color quality in terms of yellow and red (both varying from glass to glass).

(2) The practical equivalent in terms of 35-Y x-red.

(3) The sunlight transmission for (a) unidirectional illumination normal to the surface of the glass, and (b) diffuse illumination.

(4) The percentage difference between the transmission for diffuse and unidirectional illumination.

(5) The percentage departure from the sunlight transmission for standard 35-Y.

(6) The percentage departure from the sunlight transmission proper to the yellow numeral assigned to the glass in the present calibration.

The matter of most interest to the chemist using these glasses under present conditions will be the practical equivalent. This states that, in quality of color (hue and saturation), the glass is practically equivalent to standard 35-Y + x-red where x has been determined for each glass from a great number of observations by three different observers. The maximum value of x (i. e. the numeral of the red glass required to be combined with standard 35-Y in order to match the test glass) is only 0.24. In other words, in this collection of sixty-five glasses, the one farthest from correct can be practically matched in hue and saturation by a combination consisting of standard 35-Y and 0.24-R. However, nearly all of these glasses are reddish relative to the standard, the average error being about 0.11-R.

The errors in transmission for sunlight are large enough to be important in only a few cases.

The spectral transmission curves of a number of these glasses are being plotted and compared with the standard. (Priest, Gibson, Judd, Walker, Brown, Riley).

II. Temperature Coefficient of Color of Lovibond Glasses and Cotton Seed Oil.

This investigation, mentioned in the report for February, has been extended.

The determinations on the 35-Y glass alone have been repeated by another observer with results in substantial agreement with the previous determination. Similar determinations have been made on the glass combination 35-Y 7.2-R and on cotton seed oil itself. It is found that the changes in the red and yellow glasses are, to a certain extent, compensating so that the resultant change for the combination is less than for 35-Y alone. A

temperature change of about 20°C would be required to change the color by 0.1-R. Similar (preliminary) determinations on the oil (two samples, about 35-Y 7-R) itself indicate clearly that the changes in quality of color are even smaller than for the glasses. They are quite negligible for a temperature change of 25°C. The transmission of the oil increases very slowly with temperature, but this change (about 2% for temperature change of 25°C) is also entirely negligible in the practice of color grading oil. (Judd).

III. Further Calibration of Bureau of Standards Set of Lovibond Yellow Glasses (B. S. 9940).

Spectral transmission measurements have been made for the following yellow glasses (designated by the makers' marks):

0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.10, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70, 0.80, 0.90.

The experimental work on these determinations is nearly completed. (Gibson, Brown).

IV. Sensibility to Change in Yellow and Red at 35-Y and at 35-Y 7.6-R on the Lovibond Scale.

In order to check and supplement the estimates of sensibility given in the February report, further observations have been made to obtain estimates of least read and yellow differences perceptible with certainty at 35-Y and at 35-Y 7.6-R. These estimates are as follows:

Experiments have also been made to discover how these sensibilities depend upon brightness. Estimates of sensibility were made at four widely different brightness levels, the highest being very much higher than would ever be used in practical work and the lowest, much lower than would be used. (The respective retinal illuminations were roughly 10,000 photons, 1,000 photons, 100 photons, 10 photons.) The following estimates of least differences perceptible with certainty at 35-Y were made by Judd.

Retinal Illumination	Yellow dif.	Red dif.
10000 photons	1.2	0.05
1000	1.3	.06
100	1.7	.07
10	4.0	.10

It will be noted that the sensibility is nearly constant over a very wide range of ordinary brightness levels such as are commonly used. There is, however, as would be expected, a notable decrease in sensibility at very low brightness. It is probably fair to say that the sensibility is practically constant over a brightness range which the observer would instinctively feel to be satisfactory for such observations. (Judd, Walker, Priest).

V. Approximate Empiric Equivalence of Small Differences in Red and Small Differences in Yellow at 35-Y on the Lovibond Scale.

The approximate empiric equivalence of small differences in red

	Least Differences Perceptible With Certainty			
	At 35-Y		At 35-Y 7-6-R	
	Yel. dif.	Red dif.	Yel. dif.	Red dif.
Estimated by Walker, at moderate brightness, north sky illumination	1.5	0.028	5.6	....
Estimated by Judd, at very high brightness, artificial sunlight	1.2	0.05	1.3	0.068

and yellow at about 35-Y, mentioned in the February report, has been investigated more carefully. The original observation (by Judd) that 0.1-R might be substituted for 5-Y has been substantially verified by two other observers (Priest and Walker). It has also been noted that the basis of this equivalence is equality of dominant wavelengths. It has been shown by computation that the increase in dominant wavelengths due to adding 5-Y is equal to the increase due to adding O.1 R. The equality of dominant wavelengths appears to be the determining element in the empiric color match. The increase in purity due to adding the yellow is much greater than the increase due to red; but this is of relatively little importance in determining the color match when only small differences are involved. For differences greater than 0.2-R (or 10-Y) this practical equivalence begins to break down. That is, if we have a two-part matched field (at 35-Y) and add yellow to one side and red to the other in the ratio of 50 to 1, the side to which the yellow is added will appear more saturated if the yellow increment is greater than about 10. (Priest, Judd, Walker).

VI. Review and Reduction of Earlier Data on Bureau of Standards Lovibond Red Glasses (B. S. 9940).

The standard red scale adopted by Priest and Gibson in May, 1927, is based fundamentally on the spectral transmission of the glasses determined by Gibson and Harris (years 1923-24) as published in B. S. Sci. Paper 547. Less reliable data for glasses of nominal integral numerals from 3 to 20, inclusive, by Dr. M. Katherine Frehafer (unpublished, but preserved in our files) have been available since 1920. Using these data, the computation analogous to the first step in obtaining the Priest-Gibson numerals has been carried through. This computation is sufficient to show to what extent the numerals are affected by computing them from these entirely independent data on spectral transmission. No weight is to be attached to these earlier results in determining the accurate values of the numerals to be adopted. They are of interest, however, in the following aspects:

(1) They show that approximately the correct numerals are obtained from spectral transmission data much less extensive and precise than the data of Gibson and Harris.

(2) They indicate independently that there are no gross errors in the numerals due to unknown errors in the spectral transmission data of Gibson and Harris.

The following table shows the discrepancies in numerals computed from the two sets of data:

Maker's Numeral	Differences in Computed Numerals (Frehafer Data Minus Gibson-Harris Data)
3.0	+0.02
4.0	— .03
5.0	— .09
6.0	— .11
7.0	— .05
7.6	— .10
8.0	— .02
9.0	+ .04
10.0	— .14
11.0	+ .07
12.0	— .01
13.0	+ .04
14.0	+ .19
15.0	+ .15
16.0	— .22
17.0	+ .29
18.0	+ .10
19.0	+ .11
20.0	— .40

(Gibson, Riley)

VII. Further Data on Bureau of Standards Lovibond Red Glasses (B. S. 9940).

The spectral transmission of red glass marked 1.75 (maker's numeral) in the Bureau of Standards set (B. S. 9940) has been determined.

Three more red glasses in the Bureau of Standards set (B. S. 9940) have been calibrated (by computation from spectral transmission) in terms of the scale of Priest and Gibson. The results are as follows:

Maker's Numeral	Priest-Gibson Numeral
1.75	1.92
1.85	2.10
3.7	3.80

We have now exhausted the possibilities in selection of individual glasses (from this set) to represent exact tenths and exact integers from 1 to 10 on the Priest-Gibson scale as adopted in May, 1927. The final findings are given in the following table:

Desired Exact Numeral	Maker's Numeral on Glass Selected as Closest to Desired Value	Computed Numeral (Priest-Gibson Scale)	Computed Minus Desired
0.100	0.02	0.104	+0.004
.200	.13	.199	— .001
.300	.18	.296	— .004
.400	.28	.365	— .035
.500	.38	.495	— .005
.600	.46	.593	— .007
.700	.56	.711	+ .011
.800	.64	.806	+ .006
.900	.74	.900	.000
1.000	.86	1.003	+ .003
2.00	1.8	1.95	— .05
3.00	2.8	2.99	— .01
4.00	3.9	3.94	— .06
5.00	4.9	5.08	+ .08
6.00	5.6	6.16	+ .16
7.00	6.8	6.85	— .15
8.00	8.2	8.04	+ .04
9.00	9.0	9.17	+ .17
10.00	9.8	10.00	.00

(Gibson, Walker)

VIII. New Equipment for Comparing Lovibond Glasses in Artificial Daylight and for Tests of Color Sense.

Equipment designed to be used with the Martens photometer in comparing Lovibond glasses in artificial sunlight has been constructed and installed. It is now being used in the routine examination of glasses submitted by the A.O.C.S. This new equipment provides a much higher field brightness than has been used heretofore. Comparison of glasses need no longer be delayed because of lack of suitable illumination on dark days. The new equipment, accessory to the Martens photometer, consists essentially of:

(1) A magnesia lined sheet metal lamp inclosure containing two 100-watt gas-filled tungsten lamps. The light used proceeds from the white wall of this inclosure through a hole in one side.

(2) A Davis-Gibson filter which reduces the light to equivalence with noon sunlight.

(3) A biprism and lenses attached to the Martens photometer so as to properly direct the light and give a uniform field of view in the photometer.

A few glasses previously graded in natural north skylight have been regraded with the new apparatus with entirely consistent results.

This apparatus will also serve for tests of color sense such as were made at Memphis by Priest in May, 1927 (See OIL AND FAT INDUSTRIES, March, 1928). It is in fact the same apparatus with the added feature of constant standard artificial sunlight illumination. The variability of natural illumination being eliminated, the results for different observers will be comparable with much less question as to the significance of the comparison. (Priest).

IX. Design of Instrument for Using Lovibond Glasses.

An instrument intended to greatly increase the convenience and accuracy of using the Lovibond glasses in color grading oil has been designed and is now being constructed in the Bureau of Standards instrument shop. The essential features of this instrument are:

(1) Use of the Martens photometer as an observing instrument and as a means of obtaining a brightness match and a measurement of transmission.

(2) Mounting of glasses in wheels as in Bailey's colorimeter.

(3) Use of standard artificial daylight. (Priest).

X. Progress on Routine Calibration of Red Glasses Submitted by A.O.C.S.

Twenty-five red glasses submitted February 17th have been graded, reported, and returned. (Date of report, March 3rd. Date of shipment to Mr. Putland, March 5th.)

Twenty-five red glasses submitted March 5th have been graded, reported and returned. (Date of report, March 10th. Date of shipment to Mr. Pultand, March 14th.)

The grading of twenty-four red glasses submitted March 16th is nearly completed. (One glass received without A.O.C.S. No. in this shipment was returned immediately without being graded.)

Twenty-four red glasses were received March 29th.

Including the glasses received March 16th, the total number of red glasses graded under the present arrangement for routine grading (First lot submitted January 16, 1928) has been 117. (Walker).

IRWIN G. PRIEST,
Chief, Colorimetry Section

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of OIL AND FAT INDUSTRIES, published monthly, at New York, N. Y., for April 1, 1928.

State of New York } ss.:
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Alan Porter Lee, who, having been duly sworn according to law, deposes and says that he is the Editor of the OIL AND FAT INDUSTRIES, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers, are:
Publisher, Russell Palmer, 71 Columbia St., Seattle, Wash.; Editor, Alan Porter Lee, 220 W. 42nd St., New York City; Managing Editor, none; Business Manager, Alan Porter Lee, 220 W. 42nd St., New York City.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Russell Palmer, 71 Columbia St., Seattle, Wash.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is: (This information is required from daily publications only.)

ALAN PORTER LEE, Editor.

Sworn to and subscribed before me this 4th day of April, 1928.
(Seal) Johanna E. Schult, Notary Public.
N. Y. Reg. No. 0-919. N. Y. County Clerk's No. 1326. Queen's County Clerk's No. 2339. Reg. No. 2601.
(My commission expires March 30th, 1930.)